

CLAIMS

1. A semiconductor device having a multilayer structure comprising an insulating film including silicon (Si) formed on a principle plane side of a semiconductor substrate, a first conductive film formed in contact with said insulating film, and a second conductive film formed in contact with said first conductive film, wherein said second conductive film has copper (Cu) as a main constituent element, said first conductive film has as a main constituent element one kind of element selected from the group consisting of at least rhodium (Rh), ruthenium (Ru), iridium (Ir), osmium (Os), and platinum (Pt), and said first conductive film contains as an added element one kind of element selected from the group consisting of at least palladium (Pd), cobalt (Co), nickel (Ni), and titanium (Ti).
2. A semiconductor device having a multilayer structure comprising an insulating film including silicon (Si) formed on a principle plane side of a semiconductor substrate, a first conductive film formed in contact with said insulating film, and a second conductive film formed in contact with said first conductive film, wherein said second conductive film has copper (Cu) as a main constituent element, said first conductive film has as a main constituent element one kind of element selected from the group consisting

of at least rhodium (Rh), ruthenium (Ru), iridium (Ir), osmium (Os), and platinum (Pt), and said first conductive film contains as an added element one kind of element selected from the group consisting of at least palladium (Pd), cobalt (Co), nickel (Ni), and titanium (Ti) with a concentration of not less than 10 at.% and not more than 25 at.%.

3. A semiconductor device having a multilayer structure comprising an first conductive film formed on a principle plane side of a semiconductor substrate, and a copper (Cu) film or a copper (Cu) alloy film formed in contact with said first conductive film, wherein said first conductive film has as a main constituent element one kind of element selected from the group consisting of at least rhodium (Rh), ruthenium (Ru), iridium (Ir), osmium (Os), and platinum (Pt), and said first conductive film contains as an added element one kind of element selected from the group consisting of at least palladium (Pd), cobalt (Co), nickel (Ni), and titanium (Ti) with a concentration of not less than 0.14 at.% and not more than 25 at.%.

4. A semiconductor device having a multilayer structure comprising an first conductive film formed on a principle plane side of a semiconductor substrate, and a copper (Cu) film or a copper (Cu) alloy film formed in contact with said first conductive film, wherein said first conductive film has as a main

constituent element one kind of element selected from the group consisting of at least rhodium (Rh), ruthenium (Ru), iridium (Ir), osmium (Os), and platinum (Pt), and said first conductive film contains palladium (Pd) with a concentration of not less than 0.14 at.% and not more than 25 at.%.

5. A semiconductor device having a multilayer structure comprising an first conductive film formed on a principle plane side of a semiconductor substrate, and a copper (Cu) film or a copper (Cu) alloy film formed in contact with said first conductive film, wherein said first conductive film has as a main constituent material at least one kind of element selected from the group consisting of rhodium oxide, ruthenium oxide, iridium oxide, and osmium oxide, and said first conductive film contains as an added element one kind of element selected from the group consisting of at least palladium (Pd), cobalt (Co), nickel (Ni), and titanium (Ti) with a concentration of not less than 0.14 at.% and not more than 25 at.%.

6. A semiconductor device having a multilayer structure comprising an first conductive film formed on a principle plane side of a semiconductor substrate, and a gold (Au) film or a gold (Au) alloy film formed in contact with said first conductive film, wherein said first conductive film has as a main constituent element one kind of element selected from the group consisting of at least rhodium (Rh), ruthenium (Ru),

iridium (Ir), osmium (Os), and platinum (Pt), and said first conductive film contains as an added element one kind of element selected from the group consisting of at least palladium (Pd), cobalt (Co), nickel (Ni), and titanium (Ti) with a concentration of not less than 0.14 at.% and not more than 25 at.%.

7. A semiconductor device having a multilayer structure comprising an first conductive film formed on a principle plane side of a semiconductor substrate, and a silver (Ag) film or a silver (Ag) alloy film formed in contact with said first conductive film, wherein said first conductive film has as a main constituent element one kind of element selected from the group consisting of at least rhodium (Rh), ruthenium (Ru), iridium (Ir), osmium (Os), and platinum (Pt), and said first conductive film contains as an added element one kind of element selected from the group consisting of at least palladium (Pd), cobalt (Co), nickel (Ni), and titanium (Ti) with a concentration of not less than 0.14 at.% and not more than 25 at.%.

8. A semiconductor device having a multilayer structure comprising an first conductive film formed on a principle plane side of a semiconductor substrate, and a platinum (Pt) film or a platinum (Pt) alloy film formed in contact with said first conductive film, wherein said first conductive film has osmium (Os) as a main constituent element, and said first conductive

film contains as an added element one kind of element selected from the group consisting of at least palladium (Pd), cobalt (Co), nickel (Ni), and titanium (Ti) with a concentration of not less than 0.14 at.% and not more than 25 at.%.

9. A semiconductor device having a multilayer structure comprising on a principle plane side of a semiconductor substrate an insulating film including silicon (Si), a first conductive film formed in contact with said insulating film, and a second conductive film formed in contact with said first conductive film, wherein said second conductive film has copper (Cu) as a main constituent element, said first conductive film has as a main constituent element one kind of element selected from the group consisting of at least rhodium (Rh), ruthenium (Ru), iridium (Ir), osmium (Os), and platinum (Pt), said first conductive film contains at least one different kind of element in addition to said main constituent element, a difference between an atomic radius of at least one kind of element among said different kinds of elements and an atomic radius of said main constituent element is not more than 10%, and a bond energy between said different kind of element and silicon (Si) is not less than 1.9 times that of said main constituent element of said first conductive film and silicon (Si).

10. A semiconductor device having a multilayer structure comprising on a principle plane side of a

semiconductor substrate an insulating film including silicon (Si), a first conductive film formed in contact with said insulating film, and a second conductive film formed in contact with said first conductive film, wherein said second conductive film has copper (Cu) as a main constituent element, a difference $\{|ap - an|/ap\} \times 100 = A(\%)$ between a short side an in a unit rectangular cell of a closest packed crystal plane formed by said main constituent element of said first conductive film and a short side ap in a unit rectangular cell of a closest packed crystal plane formed by said copper (Cu) element and a difference $\{|bp - bn|/bp\} \times 100 = B(\%)$ between a long side bn in the unit rectangular cell of the closest packed crystal plane formed by said main constituent element of said first conductive film and a long side bp in the unit rectangular cell of the closest packed crystal plane formed by said copper (Cu) element satisfy an inequality $\{A + B \times (ap/bp)\} < 13\%$, a melting point of said main constituent element of said first conductive film is not less than 1.4 times that of copper (Cu), said first conductive film contains as an added element at least one different kind of element in addition to said main constituent element, a difference between an atomic radius of at least one kind of added element among said different kinds of elements and an atomic radius of said main constituent element of said first conductive film is not more than 10%, and a bond energy

between said added element and silicon (Si) is not less than 1.9 times that of said main constituent element of said first conductive film and silicon (Si).

11. A semiconductor device having a multilayer structure comprising on a principle plane side of a semiconductor substrate an insulating film including silicon (Si), a first conductive film formed in contact with said insulating film, and a second conductive film formed in contact with said first conductive film, wherein a difference $\{|ap - an|/ap\} \times 100 = A(\%)$ between a short side an in a unit rectangular cell of a closest packed crystal plane formed by said main constituent element of said first conductive film and a short side ap in a unit rectangular cell of a closest packed crystal plane formed by said main constituent element of said second conductive film and a difference $\{|bp - bn|/bp\} \times 100 = B(\%)$ between a long side bn in the unit rectangular cell of the closest packed crystal plane formed by said main constituent element of said first conductive film and a long side bp in the unit rectangular cell of the closest packed crystal plane formed by said main constituent element of said second conductive film satisfy an inequality $\{A + B \times (ap/bp)\} < 13\%$, a melting point of said main constituent element of said first conductive film is not less than 1.4 times that of said main constituent element of said second conductive film, said first conductive film contains as an added element at least one different

kind of element in addition to said main constituent element, a difference between an atomic radius of at least one kind of added element among said different kinds of elements and an atomic radius of said main constituent element of said first conductive film is not more than 10%, and a bond energy between said added element and silicon (Si) is not less than 1.9 times that of said main constituent element of said first conductive film and silicon (Si).